THE ECOLOGY OF AN ELFIN FOREST IN PUERTO RICO, 11. THE LEAFY HEPATICAE OF PICO DEL OESTE [1]

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THE SUMMIT OF PICO DEL OESTE in the Luquillo Mountains of Puerto Rico, with an elevation of 1050 meters, is covered by an elfin forest or thicket from 2 to 5 meters high which in places, especially those covered by the low shrub, is almost inpenetrable, while in areas of taller trees the going is less difficult. In any case, the canopy is more or less closed throughout and even during sunny periods the light is diffuse. The rainfall is about 200 inches per year.

The area in which the collections were made has been under intensive

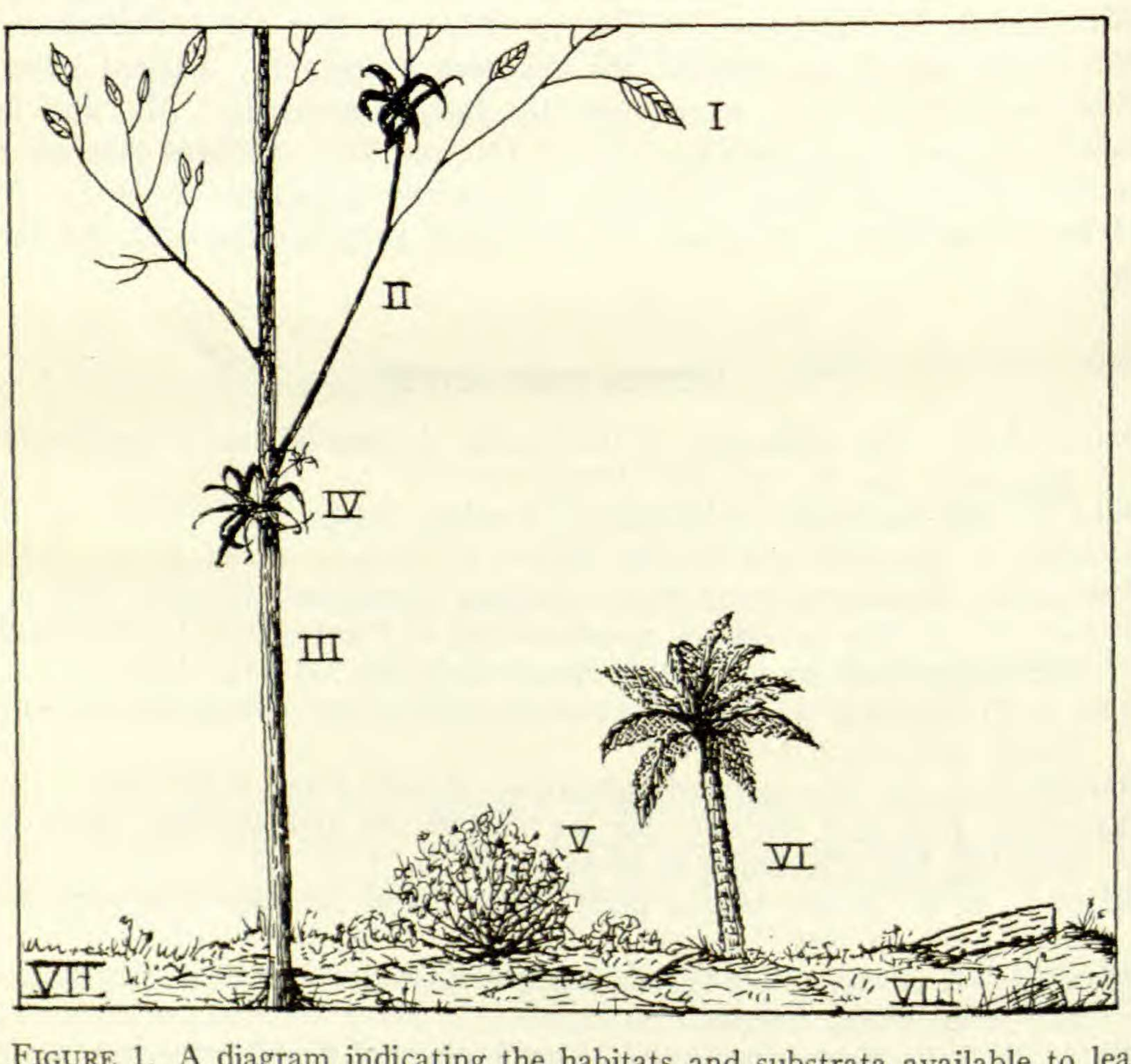
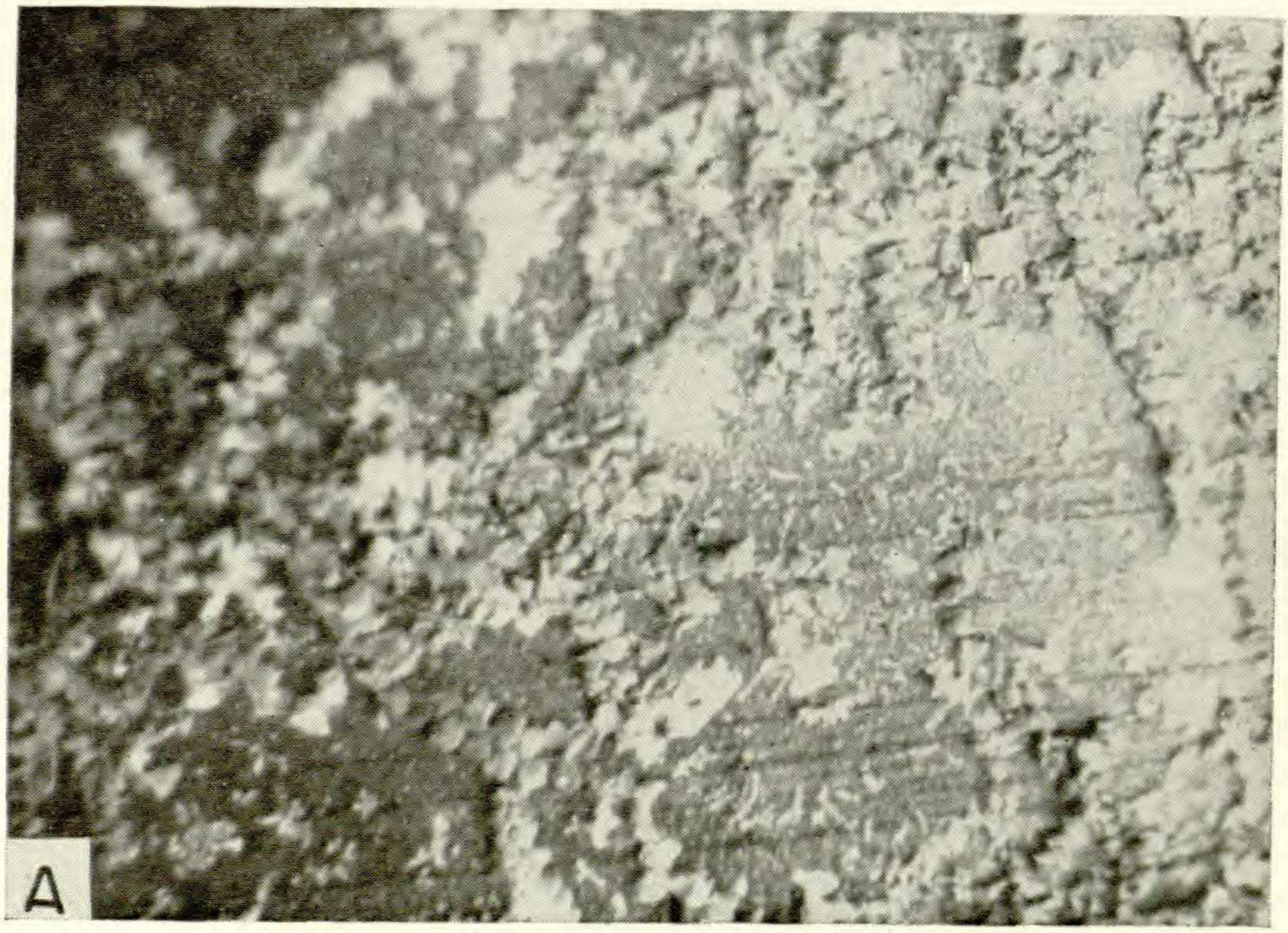


FIGURE 1. A diagram indicating the habitats and substrata available to leafy Hepaticae in the elfin forest: I, leaf; II, twigs and branches; III, trunk of tree; IV, bromeliad epiphyte; V, shrub; VI, tree fern; VII, the ground; VIII, log.

[1] Work relating to a project supported by National Science Foundation Grant, No. GB 7138, Margaret Fulford, principal investigator.



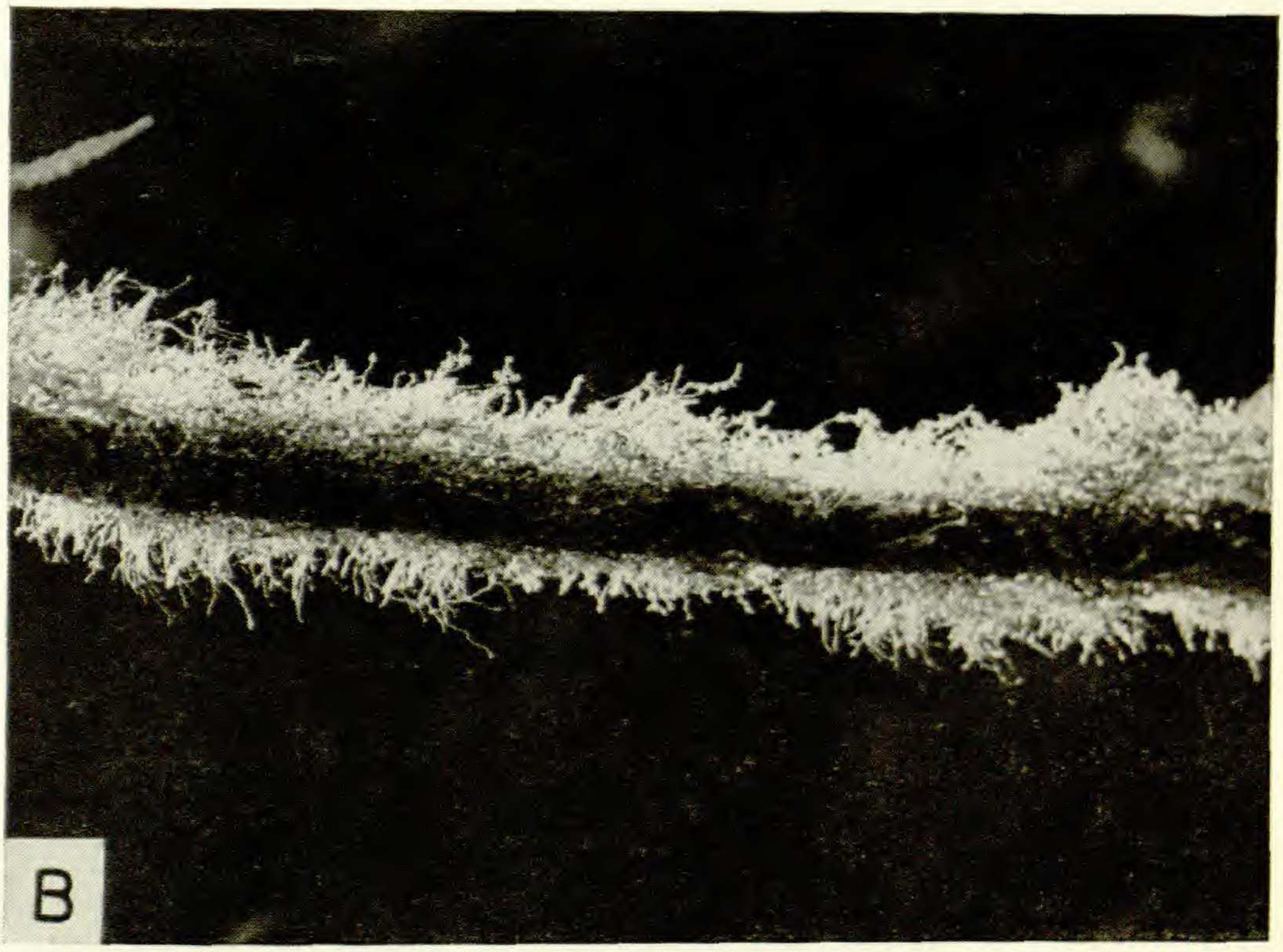


FIGURE 2A. Portion of a leaf covered with several species of leafy Hepaticae.
FIGURE 2B. Portion of a tree trunk covered with a loose mat of leafy Hepaticae.

investigation by Dr. R. A. Howard for a number of years and has already been described in detail (Howard, 1968). Most of our collections were made in the vicinity of his study trail.

As pointed out by many investigators (see Howard, 1968) such a type of woody vegetation has been variously described as elfin forest, elfin woodland, montane thicket, and mossy forest. At least in Puerto Rico, this "mossy forest" on Pico del Oeste, El Yunque, Mt. Britton, and El Toro, is mossy only in appearance, for leafy Hepaticae comprise 90 percent or more of the bryophyte flora of these areas. While the general aspect of the vegetation of these four peaks is similar (Howard, 1968), the actual composition of the leafy hepatic flora is different for each of them. This will be demonstrated in a later paper.

These leafy hepatics occupy all sorts of niches and substrata (FIGURE 1), and each may support several growth forms. The plants cover the ground, often in cushions up to a foot thick, cover the tree trunks and branches in large or small appressed mats, loose mats, deep tufts, large "balls" to 6 inches or more in diameter, or hang in festoons to two feet or more in length (FIGURES 2B, 3), or cover the leaves of the trees and shrubs, herbaceous plants, and ferns (FIGURE 2A).

In a general way, the variety of substrata and growth forms may be classified in the following manner:

I. LEAVES.
- a. Species with a tightly appressed growth habit, — in particular, young plants developing from discoid gemmae (gemmalings), in the genera *Colura*, *Cyclolejeunea*, *Diplasiolejeunea*, and *Radula*, or from tiny small-leaved branches in the genera *Drepanolejeunea*, *Prionolejeunea*, and others.
- b. Loose mats, usually on older leaves. Large colonies of the plants named under "a" show this form. Additional gemmae and tiny branches are caught in such mats.
- c. Tufts to 1 cm. high often become established within the older mats, especially the genus *Adelanthus*.

II. TWIGS AND BRANCHES.
- a. Appressed mats — of *Ceratolejeunea* spp., *Prionolejeunea* spp., *Frullania*, *Radula*, etc.
- b–c. Loose mats to deep tufts — of *Trachylejeunea*, *Bazzania longa*, *B. longistipula*, *Lepidozia patens*, *Plagiochila* spp., etc.
- d. "Balls" to 6 inches across — of *Bazzania stolonifera*, *B. breuteliana*, *Lepidozia patens*, *Plagiochila* spp.
- e. Pendent forms, to a foot or more long — of *Herberta*, *Cystolejeunea*, *Plagiochila* spp. and *Syzygiella*.

III. TREE TRUNKS.

These support a variety of growth forms, limited only by the time and space available. The forms and species are similar to those of twigs and branches.

IV. BROMELIAD EPIPHYTES.
- a. Appressed forms, especially small plants of *Colura*, probably developed from gemmae.

V–VI. SHRUBS AND FERNS.
- a. Appressed forms — on the leaves and petioles. The stems support the same

FIGURE 3. Tree trunks in the elfin forest with leafy Hepaticae in loose mats or pendent.

range of growth forms and species as are to be found on the tree trunks and branches.

VII. THE GROUND.

a. Appressed forms or low tufts — occupy spots of recently exposed soil, as *Alobiellopsis*.

b. Deep tufts and mounds — cover most of the area and form a deep, spongy, soggy, cushion over the forest floor.

VIII. LOGS.

a. Appressed forms — a few slender forms as *Nowellia*, *Telaranea* and *Cephalozia* soon become established but they are soon replaced by the rapidly growing larger species of the tree trunks and ground.

Most of the species are tinged with brown and some become bronze. A few are reddish to deep purple-black.

Many individual plants, especially those on leaves, are subjected many times a day, to a deluge of rain followed immediately by high wind, sun, and a rapid drying out, so that they survive frequent periods of xerophytism. This is particularly true of the unistratose, discoid gemmae and the gemmalings of the leaf-inhabiting species of *Colura*, *Cyclolejeunea*, and *Diplasiolejeunea* which are so abundant. Those plants in colonies are not so exposed.

Leafy Hepaticae may reproduce by spores, gemmae of various sorts, by specialized deciduous branches, by short, small-leaved branches, and by fragmentation of a stem or leaf. The first arrivals on a new leaf are, for the most part, the discoid gemmae of *Colura*, *Cyclolejeunea* and *Diplasiolejeunea*.

Both *Colura clavigera* (FIGURE 4) and *Cl. rhynchophora* (FIGURE 5a) have highly specialized leaves, for most of the leaf is an inflated water-sac with a special valve opening. Numerous insects are caught in these traps. The superficial unistratose, discoid gemmae develop from cells of the leaf (FIGURE 5a, G). The details of development of similar gemmae in other genera have been described by Evans (1911, 1912). There are usually three specialized cells on the margin which serve as "Haftorgane" or organs of attachment (FIGURE 5b, A). Such cells project at right angles to the surfaces of the gemma and the slime secreted from the tips serves to attach the gemma to the leaf. The new leafy plant develops through the activities of an apical cell which develops from a cell of the margin. The gemmae of *Diplasiolejeunea* (FIGURE 6a, b) are of the same general form.

In the genus *Cyclolejeunea*, perhaps the most widely occurring of the gemmiparous leaf-inhabiting taxa, gemmae develop from the marginal cells of the leaf (FIGURE 7a). The large discoid gemma of *C. convexistipa* (FIGURE 8), is unistratose and watch-glass shaped, and according to Evans (1904), apparently falls on the leaf with the concave side down and the margin appressed to the leaf surface, thus creating a water-holding space in the middle. Three or four long rhizoids and numerous short branched ones develop from the marginal cells. The latter are slime secreting and serve to anchor the gemma to the leaf (FIGURE 8, R). The

leafy stem develops from an apical cell on the margin. In *C. accedens* the gemma has only two long unbranched rhizoids (FIGURE 7b, R), bent over the lower surface, and an abundance of short, branched, slime-secreting marginal ones. The apical cell of the gemma gives rise to an oblong protonema or gemmothallus (FIGURE 7c, T), and the leafy plant develops from the margin of this latter thallus.

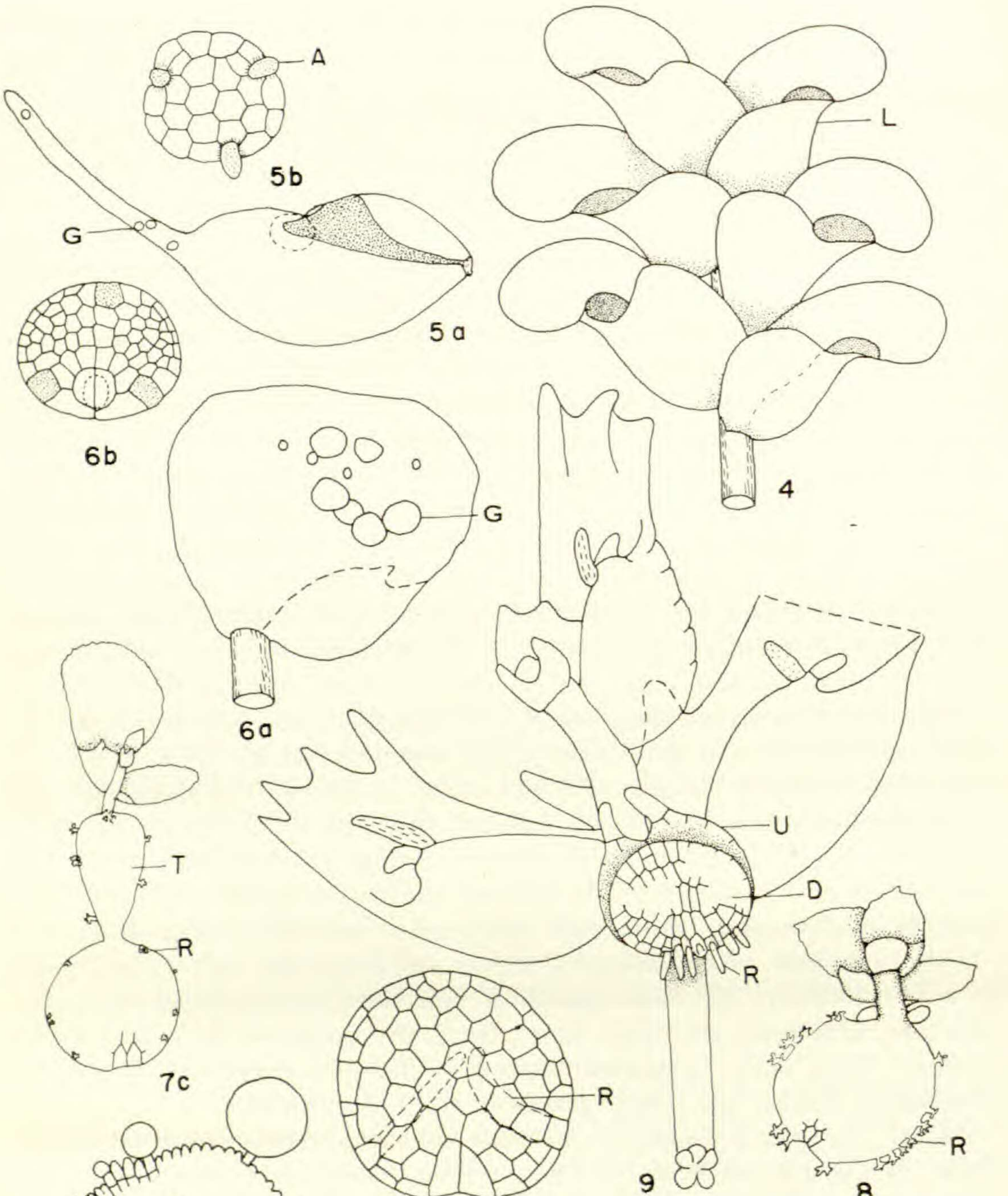
Still another highly specialized means of vegetative reproduction among the leaf-inhabiting species occurs in the very common *Drepanolejeunea inchoata*. The plants are relatively large, with broad, coarsely toothed leaves, and in addition to the branches with adult leaves, there are some with smaller leaves of the same sort, and some with very slender lanceolate leaves. These latter branches produce even smaller easily detached branches, the propagula. The propagulum (FIGURE 9) is a minute, slender branch with several leaves and underleaves. The first underleaf (FIGURE 9, U) is the largest and has, over much of its surface, a circular "suction disc" with slime secreting rhizoids from the marginal cells. This disc serves as an anchoring mechanism for the branchlet. Such propagula have been described by Evans (1902) for several Puerto Rican genera. In a study of epiphyllous hepatics of El Salvador, Winkler (1967) has also described the leaf-adaptions of many of these species.

Small-leaved microphyllous or flagelliform branches are developed in many species. In *Ceratolejeunea flagelliformis* (FIGURE 10 a *vs* 10 b) and *Prionolejeunea aemula* (FIGURE 13 a *vs* 13 b), the whole branch is readily detached and blown about, while in *Bazzania longistipula* (FIGURE 11 a *vs* 11 b) and *Calypogeia cellulosa* (FIGURE 12 a *vs* 12 b), the small-leaved branches are brittle and tend to break into short lengths. Both types form new plants and colonies in favorable surroundings.

Large numbers of fragments of leaves and stems are also to be found in any collection. In most species it has been demonstrated that the cells are totipotent and that new plants are produced in considerable numbers from such fragments, especially in such genera as *Bazzania*, *Plagiochila*, *Radula* and many genera of the Lejeuneaceae.

All of the above described methods of reproduction occur in abundance in the area of Pico del Oeste. This is indicated from the occurrence on the pollen-trap slides and the numbers of sporelings, gemmalings, specialized branches, and stem and leaf fragments found in our collections. They are carried by the wind, strong up- and down-drafts, and by driving rains. But these are examples of short-distance dispersals and it must be kept in mind that even on the four peaks of the Luquillo Mountains there is a considerable difference in the hepatic flora. How much of this difference is due to a matter of dispersal and how much to habitat diffierences is an open question, since the hepatics require only microhabitats within any area.

There is also a considerable difference in composition between the hepatic flora of Pico del Oeste and that at lower elevations, namely the Rain Forest, at 500 to 625 meters, or the several collecting localities at 700 to 750 meters.



FIGURES 4–9. Some leaf-inhabiting species. FIG. 4. *Colura clavigera*, showing the strongly inflated leaves (L), × 85. FIG. 5 a. *Cl. rhynchophora*, an inflated leaf with discoid gemmae (G), on the long-cylindrical tip, × 85. FIG. 5 b. A gemma with three attaching organs (A), × 240. FIG. 6 a. *Diplasiolejeunea unidentata*, leaf with discoid gemmae (G), × 60. FIG. 6 b. A gemma with three attaching organs, × 240. FIG. 7 a. *Cyclolejeunea accedens*, diagram of a portion of a leaf margin with discoid gemmae, × 60. FIG. 7 b. Gemma with two large attachment cells at its base, and a pair of long rhizoids (R) on the lower side. FIG. 7 c. Gemmaling, with the gemma below and the gemmothallus (T) with a leafy plant above. FIG. 8. *C. convexistipa*, gemma with short, branched, marginal rhizoids (R), and a young leafy plant. FIG. 9. *Drepanolejeunea inchoata*, a tiny propagulum with three leaves and two underleaves (U); the first underleaf bears a large "suction disc" with marginal rhizoids (R), which serve to attach the propagulum to a leaf, × 240. FIGURES 7 b, c, and 8 after Evans (1904).

There is evidence that certain of the species from these areas may have been repeatedly blown into the area of Pico del Oeste, but apparently they have not become established.

In any patch of hepatics here, there are one to several dominants and as many as 18 additional species, some of which are tiny fragments which have been caught in the tangled growth. No one of the collections contained only a single species. The fragments of stems with growing tips had two or three to a dozen leaves, often smaller or conspicuously reduced in size. The number of such stems which actually survive and grow into typical plants is not known.

In all, 95 collections of leafy Hepaticae were made on Pico del Oeste. Mr. Stotler examined all of the packets in great detail and made a permanent slide of each species in each packet, more than 650 slides in all. These include 15 families, 34 genera, and 62 species.

We wish to thank Drs. Carroll E. Wood and Richard A. Howard for collecting material (38 packets), and Dr. Howard for his hospitality, and for guiding us through the area. I also wish to thank the National Science Foundation for some financial aid. The specimens are housed at the University of Cincinnati.

In the following list an asterisk (*) denotes species reported from Puerto Rico for the first time. The numbers following each species indicate the number of times that species occurred in the total number of packets. In the distribution data "known" indicates that the data is taken from a monographic treatment of the genus, and "reported" indicates that the records are from the older literature and from lists.

TRICHOCOLEACEAE

Trichocolea flaccida (Spr.) Jack & Steph. 2/95.

With other hepatics on a tree trunk and on a leaf. Known from throughout the West Indies; Mexico, Guatemala; Colombia, Venezuela, Ecuador, Peru, Bolivia.

ISOTACHACEAE

Neesioscyphus bicuspidatus (Steph.) Grolle. 1/95.

Soil bank. Known from Puerto Rico, Guadeloupe, Martinique.

HERBERTACEAE

Herberta divergens (Steph.) Herzog. 20/95.

In tufts or pendent on trees and shrubs, and on leaves, including *Ocotea*, *Eugenia*, *Ilex*, and *Calyptranthes*, and on leaves of *Anthurium*. Known from Puerto Rico; Costa Rica; Brazil, Bolivia.

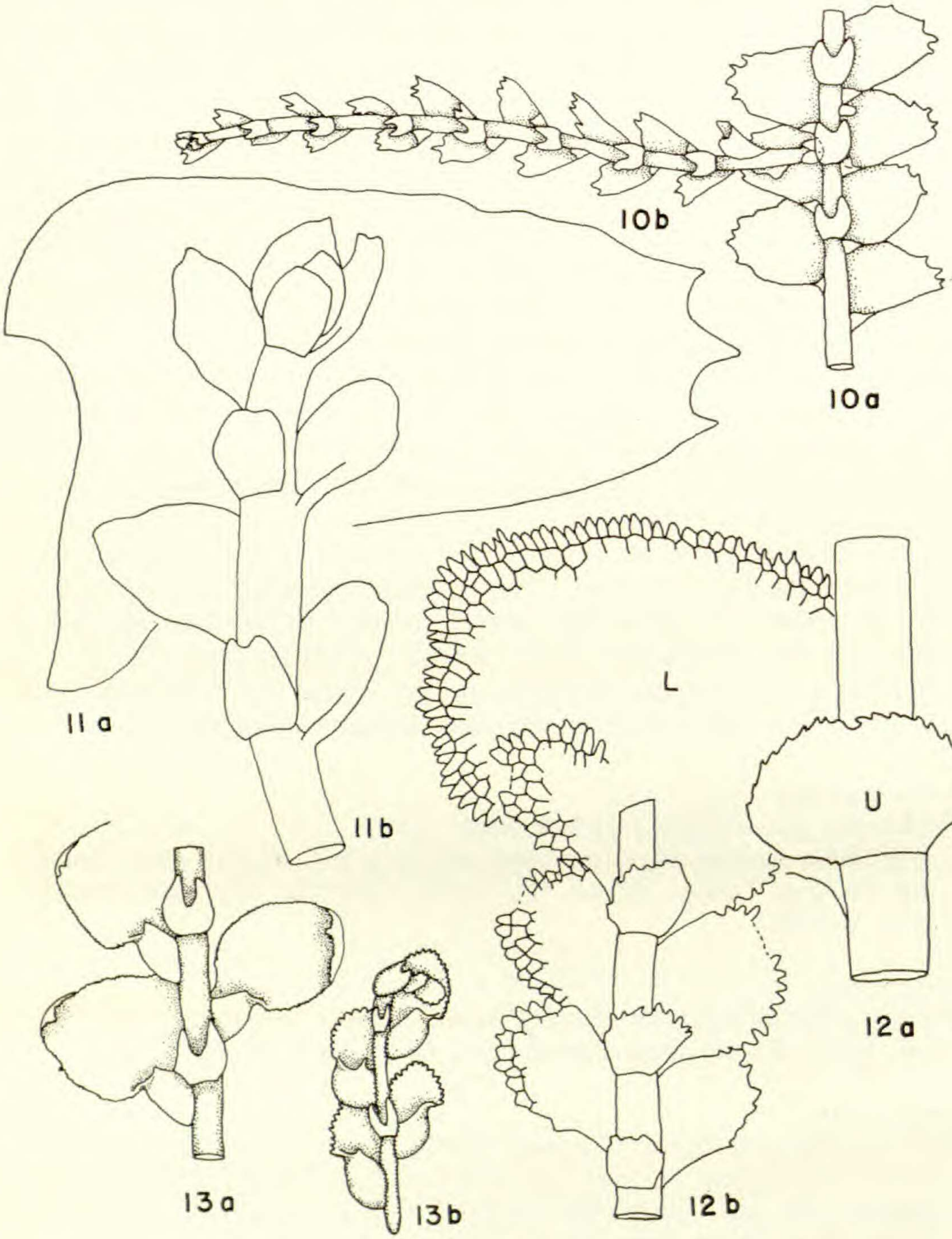
Herberta pensilis (T. Tayl.) Spr. 7/95.

In tufts or pendent on trees, shrubs, and leaves, including *Calyptranthes* and *Grammadenia*. Known from Cuba, Puerto Rico, Dominica; Costa Rica; Colombia, British Guiana, Brazil, Ecuador, Peru, Bolivia.

LEPIDOZIACEAE

Bazzania breuteliana (Lindenb. & Gott.) Trevis. 1/95.

A large "ball" on a tree trunk. Widespread in the West Indies, Central America, and the northern half of South America.



FIGURES 10–13. Some species with flagelliform or microphyllous branches. FIG. 10 a. *Ceratolejeunea flagelliformis*, adult stem, × 60. FIG. 10 b. Flagelliform branch of this species, × 60. FIG. 11 a. *Bazzania longistipula*, adult leaf, × 60. FIG. 11 b. Portion of a microphyllous branch of this species, × 60. FIG. 12 a. *Calypogeia cellulosa*, an adult leaf (L) and an underleaf (U), × 60. FIG. 12 b. Portion of a small-leaved branch of this species, × 60. FIG. 13 a. *Prionolejeunea aemula*, portion of an adult stem, × 60. FIG. 13 b. A short microphyllous branch of this species, × 60. Drawn from plants collected on Pico del Oeste.

Bazzania longa (Nees) Trevis. 27/95.

Abundant on tree trunks, twigs, and leaves, including *Tabebuia* and *Wallenia*, and on *Anthurium* and ferns. Known from Cuba, Jamaica, Puerto Rico, St. Kitts, Guadeloupe, Dominica, Martinique, and Trinidad. (Fragments of stems are common in many collections.)

Bazzania longistipula (Lindenb.) Trevis. 14/95.

In mats or deep tufts on tree trunks and branches, including *Eugenia*, *Ilex*, and *Miconia*. Known from throughout the West Indies, Central America, and tropical South America. (Fragments of stems are very common in collections in the mountains).

Bazzania roraimensis (Steph.) Fulf. 5/95.

Among other hepatics on trees. Known from Jamaica, Puerto Rico; Colombia, British Guiana, and Brazil. (All of the collections were depauperate fragments.)

Bazzania stolonifera (Sw.) Trevis. 1/95.

Forming a "ball" on a tree trunk. Common throughout tropical America.

Micropterygium carinatum (Grev.) Reim. 5/95.

With other hepatics on tree trunks and twigs. Known from Puerto Rico, Guadeloupe, Dominica, Martinique; Venezuela.

Lepidozia patens. Lindenb. 16/95.

In deep tufts on trunks and branches of trees and shrubs, including *Eugenia*, *Ocotea*, *Tabebuia*, and *Wallenia*. Known from Cuba, Jamaica, Haiti, Puerto Rico, St. Kitts, Guadeloupe, Dominica, Martinique; Guatemala; Colombia, Venezuela.

Telaranea sejuncta (Ångstr.) S. Arnell. 1/95.

Decayed log. Known from coastal eastern United States; Puerto Rico, Guadeloupe, Dominica; Mexico, Guatemala, Costa Rica, Honduras; Colombia, Venezuela, Brazil, Ecuador, Peru, Bolivia.

CALYPOGEIACEAE

Calypogeia cellulosa (Spreng.) Steph. 11/95.

Mats or among other hepatics on tree trunks and branches, leaves and over ferns. Known from Cuba, Puerto Rico, Guadeloupe, and Dominica.

Calypogeia elliottii Steph. 4/95.

In mats on tree branches, tree base, and old leaves. Known from Puerto Rico, Dominica.

Calypogeia peruviana Nees & Mont. 1/95.

On leaf of *Anthurium*. Widespread and abundant throughout tropical America. (It most commonly grows on moist banks and rocks, logs, and tree bark.)

CEPHALOZIACEAE

Cephalozia caribbeania Fulf. 1/95.

On bark, tree base. Known from Cuba, Jamaica, Puerto Rico, Guadeloupe, Dominica, Trinidad; Mexico, Guatemala, Honduras; Venezuela.

**Nowellia caribbeania* Fulf. 1/95.

On mound on bark of tree. Known from Puerto Rico; Guatemala, Honduras, Costa Rica; Venezuela.

Nowellia dominicensis Steph. 2/95. (*N. bicornis* (Spr.) Fulf.)

Among tufts of other hepatics. Known from Puerto Rico, Guadeloupe, Dominica.

ODONTOSCHISMACEAE

Alobiellopsis dominicensis (Spr.) Fulf. 1/95.

On compact soil along path. Known from Puerto Rico, Dominica, Martinique, Trinidad.

Odontoschisma prostratum (Sw.) Trevis. 1/95.

Near the base of a tree trunk. Known from eastern United States; Cuba, Jamaica, Puerto Rico, Guadeloupe, Martinique.

ZOOPSIDACEAE

Zoopsis antillana Steph. 1/95.

Among other hepatics on a tree trunk. Known from Cuba, Puerto Rico, Dominica, Trinidad.

LOPHOCOLEACEAE

Heteroscyphus elliottii (Steph.) Pagán 1/95.

Loose mat on a tree branch. Reported from Puerto Rico, Dominica.

Leptoscyphus gibbosus (T. Tayl.) Mitt. 4/95.

In mats on tree bark, occasionally on the ground. Known from Puerto Rico, Guadeloupe, Martinique.

LOPHOZIACEAE

Syzygiella perfoliata (Sw.) Spruce. 5/95.

In tufts on bark and leaves or hanging from tree branches. Known from Jamaica, Puerto Rico; Costa Rica; Brazil, Peru. (Most of the stems have most leaves conspicuously bifid.)

PLAGIOCHILACEAE

Plagiochila bidens Gott. 20/95.

On tree bark and living leaves including *Calyptranthes*, *Grammadenia*, *Micropholis*, *Ocotea*, *Trichilia*. Reported from Cuba, Puerto Rico, Dominica, Guadeloupe; Bolivia.

Plagiochila bursata (Desv.) Lindenb. 6/95.

Reported common in the mountains of the American tropics.

Plagiochila chinantlana Gott. 22/95.

On tree bark and leaves. Reported from Puerto Rico; Mexico, Costa Rica; Colombia, Peru.

plagiochila dominicensis T. Tayl. 6/95.

In large loose tufts on trees and over ferns. Reported from Cuba, Puerto Rico, Dominica; Mexico; Colombia, Venezuela.

**Plagiochila jamaicensis* Lindenb. & Hpe. 5/95.

On twigs and branches. Reported from Jamaica, Puerto Rico.

Plagiochila rutilans Lindenb. 1/95.

On trees. Reported from Cuba, Puerto Rico, Guadeloupe, Dominica, Trinidad; Costa Rica; Venezuela, British Guiana, Brazil.

**Plagiochila subbidentata* T. Tayl. 4/95.

On bark and leaves of trees and shrubs. Reported from Jamaica, Puerto Rico.

[2] **Adelanthus brevicaulis* Steph. 13/95.

[2] Not much information is available as to the nature of the shoot/sporophyte relationship or the characteristics of the sporophyte in this species. I have tentatively placed it in this family.

On trunks, branches and leaves of trees and shrubs, including *Grammadenia*, *Ocotea*, *Tabebuia*, *Wallenia*. Reported from Puerto Rico, Guadeloupe; the Andes.

SCAPANIACEAE

Scapania portoricensis Hpe. & Gott. 3/95.

On soil bank, and among other hepatics on tree bases and branches. Reported from Cuba, Jamaica, Puerto Rico; Colombia, Venezuela, Brazil, Ecuador.

RADULACEAE

Radula fendleri Gott. ex Steph. 5/95.

In mats and tufts on leaves and branches. Known from Puerto Rico, Guadeloupe, Martinique, Surinam, Venezuela.

Radula saccatiloba Steph. 15/95.

In tufts and mats on tree trunks, branches, and leaves including *Calyptranthes*, *Ocotea*, *Tabebuia*, and over ferns. Known from Cuba, Jamaica, Puerto Rico, Guadeloupe, Dominica, Martinique.

FRULLANIACEAE

**Frullania subtilissima* (Nees & Mont.) Lindenb. 6/95.

In mats on twigs and living leaves, including *Ilex* and *Micropholis*. Reported from Dominican Republic, Puerto Rico, Guadeloupe, Dominica; French Guiana, Brazil.

LEJEUNEACEAE

Ceratolejeunea flagelliformis (Steph.) Fulf. 6/95.

On bark of trees, shrubs, and on living leaves. Known from Puerto Rico, Martinique; Costa Rica. (Detached flagelliform branches are frequent.)

Ceratolejeunea maritima (Spr.) Steph. 9/95.

On bark of trees and shrubs, living leaves, and over ferns. Common throughout tropical America.

Ceratolejeunea patentissima (Hpe. & Gott.) Evans 16/95.

In mats on living leaves including *Ardisia*, *Calyptranthes*, *Ilex*, *Micropholis*. (Most of the collections belong to var. *acutifolia* Fulf., with acute leaves.) Known from Cuba, Jamaica, Puerto Rico, Guadeloupe, Martinique; Colombia, Venezuela.

Ceratolejeunea valida Evans. 45/95.

On bushes, twigs, and living leaves. Known only from Puerto Rico.

**Colura clavigera* (Gott.) Jovet-Ast. 1/95.

With other hepatics, on bark. Known from Puerto Rico, Guadeloupe.

Colura rhynchophora S. Jovet-Ast. 18/95.

On leaves including, *Guzmania* and *Vriesia*, or as short stems among other hepatics. Known from Puerto Rico, Guadeloupe.

Cyclolejeunea accedens (Gott.) Evans. 17/95.

On living leaves, more rarely as fragments among other bryophytes. Known from Puerto Rico, St. Kitts, Guadeloupe, Dominica, St. Vincent; Venezuela, Peru, Bolivia.

Cyclolejeunea convexistipa (Lehm. & Lindenb.) Evans 16/95.

On living leaves, rarely on bark, often fragments mixed with other hepatics. Both species reproduce by large, unistratose, discoid gemmae which are of frequent occurrence on leaves. Widely distributed in tropical America.

Cystolejeunea lineata (Lehm. & Lindenb.) Evans. 41/95.
On trees, often in festoons, on banks among other hepatics. Known from Puerto Rico, St. Kitts, Guadeloupe, Dominica, Martinique, St. Vincent; Colombia, French Guiana, Brazil.

Diplasiolejeunea unidentata (Lehm. & Lindenb.) Schiffn. 11/95.
Mats on leaves and twigs, including *Ilex*, *Miconia*, *Trichilia*. Known from Jamaica, Puerto Rico, Guadeloupe, Dominica, Martinique, St. Vincent; El Salvador. The species produces abundant unistratose, discoid gemmae on the leaves.

Drepanolejeunea anoplantha (Spr.) Steph. (*D. subulata* Steph.) 15/95.
On living leaves but more characteristically as small stems among other hepatics. Known from Cuba, Jamaica, Puerto Rico, St. Kitts, Guadeloupe; Venezuela, Brazil, Peru.

Drepanolejeunea crucianella (T. Tayl.) Evans. 1/95.
On leaves. Widespread in tropical America.

Drepanolejeunea evansii Bischl. (*D. infundibulata* (Spr.) Evans) 1/95.
On leaves. Known from Puerto Rico, Guadeloupe, Martinique.

Drepanolejeunea inchoata (Meissn.) Steph. 29/95.
On leaves and mixed with other hepatics. Widespread throughout tropical America. This species and probably others in this genus produce very specialized short branches for vegetative reproduction.

Drepanolejeunea fragilis Bischl. (*D. araucariae* Evans). 17/95.
On leaves and as fragments among other hepatics. Known from Jamaica, Puerto Rico, Guadeloupe; Guatemala, Costa Rica; Colombia, Surinam, Brazil.

Harpalejeunea heterodonta Evans. 12/95.
On leaves and as fragments among other hepatics. Known from Puerto Rico, Guadeloupe, Martinique; Colombia, British Guiana.

Harpalejeunea uncinata Steph. 13/95.
On bark and leaves and as fragments among other hepatics. Known from Cuba, Dominican Republic, Puerto Rico, Guadeloupe, Martinique, Trinidad; Panama.

Neurolejeunea breutelii (Gott.) Evans 1/95.
On a leaf. Known throughout tropical America.

Prionolejeunea aemula (Gott.) Evans. 19/95.
On leaves and among other hepatics. Known from Puerto Rico, St. Kitts, Guadeloupe, Dominica; Colombia, Ecuador, Peru. Small branches with smaller leaves are readily detached and are frequent among other hepatics.

Prionolejeunea aequitexta Evans. 1/95.
On living leaves. Known from Puerto Rico.

Prionolejeunea exauriculata Evans. 1/95.
On a living leaf. Known from Puerto Rico.

Prionolejeunea innovata Evans. 3/95.
In small mats on twigs, with other hepatics. Known from Puerto Rico.

Rectolejeunea phyllobola (Nees & Mont.) Evans. 1/95.
On a leaf. Southern Florida, widely distributed in the West Indies; Mexico, Costa Rica.

**Strepsilejeunea involuta* Steph. 3/95.
On bark and leaves. Reported from Puerto Rico, Dominica, St. Vincent; Brazil.

Taxilejeunea sulphurea Spr. 4/95.
In loose tufts or pendent on trees and leaves, and over banks and logs. Widespread in tropical America.
Trachylejeunea inflexa Steph. 21/95.
In mats and tufts on trees and among other hepatics. Said to be common in the American tropics.

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